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Homogenized effective temperatures from stellar libraries

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Abstract. External errors of effective temperatures of stars for selected libraries are estimated from data intercomparisons. It is found that the obtained errors are mainly in a good correspondence with the published data. The results may be used to homogenize the effective temperatures by averaging the data (with the weights inversely proportional to the squared errors) from independent sources.

Keywords : stars: fundamental parameters: effective temperatures

1. Introduction

Numerous spectral and photometric stellar catalogues of the basic atmospheric parameters (T_{eff} , $\log g$, $[\text{Fe}/\text{H}]$) are widely used for decoding the structure, evolutionary stage and chemical enrichment history of the Galaxy. The rapidly growing number of such catalogues has imposed a need for refining procedures of merging these stellar data into a single homogenized catalogue. In our recent paper (Malyuto & Shvelidze 2011), the technique has been applied where some homogeneous samples from selected catalogues of the T_{eff} values were treated by combining them in triples, quadruples, quintuples and pairs for the stars in common to determine their external errors from data intercomparisons. The T_{eff} values are then averaged (with the weights inversely proportional to the squared errors) to produce an extended mean homogenized catalogue. A somewhat different procedure of homogenization was used by Cenarro et al. (2007) where only pairs of stars were treated and heterogeneity of the published errors (or other quality data) of the parameters inside every used sample was not taken into account.

The most important and detailed information for stars is available in stellar spectral libraries with medium to high resolutions and good coverages of the Hertzsprung-Russell diagram and metallicity range. Some libraries also contain the results of an ef-

ficient parametrization of T_{eff} , $\log g$, $[\text{Fe}/\text{H}]$. Few libraries are considered here whose published T_{eff} are compared with the T_{eff} from an independent extensive homogeneous sample with the external σT_{eff} taken from our previous analysis (Malyuto & Shvelidze 2011). These comparisons allow to estimate the σT_{eff} for the considered spectral libraries, and to use the results for homogenizing the T_{eff} values.

2. Results

To estimate σT_{eff} from data intercomparisons, Malyuto & Shvelidze (2011) have selected a set of homogeneous samples. Among them there is the most populated and homogeneous sample (S.1) from the photometric catalogue of Masana, Jordi & Ribas (2006) with the published $T_{\text{eff}}=5200\text{-}6700$ K, $\sigma T_{\text{eff}}=40\text{-}60$ K and $[\text{Fe}/\text{H}] > -1.1$. For comparison with S.1, the following samples (S.2-S.5) with the stars in common were selected from the appropriate independent spectral libraries:

S.2 (Prugniel et al. 2007) – with the T_{eff} compiled from the literature for ELODIE library.

S.3 (Wu et al. 2011) – with the T_{eff} determined the use of the ULySS package from CFLIB library.

S.4 (Prugniel, Vauglin & Koleva 2011) – with the T_{eff} determined the use of the ULySS package from MILES library.

S.5 (Cenarro et al. 2007) – with the T_{eff} compiled from the literature for MILES library.

Some comparisons of the data are presented in Fig. 1. The T_{eff} from these libraries were reduced to the system of Masana et al. (2006) with the equations given on the left in this Figure. The T_{eff} differences are presented on the right in the same Figure versus the published quality data qT_{eff} from S.2 (Prugniel et al. 2007) or the published σT_{eff} from S.3 (Wu et al. 2011) and from S.4 (Prugniel et al. 2011), respectively. We see that the scatter depends on the qT_{eff} for S.2 (Prugniel et al. 2007), as expected. To deal with homogeneous data, we divided S.2 into three subsamples: S.2A with the $qT_{\text{eff}}=3\text{-}4$, S.2B with the $qT_{\text{eff}}=2$ and S.2C with the $qT_{\text{eff}}=0\text{-}1$ (the latter data are of the lowest quality). The scatters do not depend on the σT_{eff} for S.3 (Wu et al. 2011) and for S.4 (Prugniel et al. 2011) in this Figure, and there is no information on the quality data or σT_{eff} for S.5 (Cenarro et al. 2007).

The variances for T_{eff} differences between S.1, on the one hand, and S.2A, S.2B, S.2C, S.3, S.4 and S.5, on the other hand, were calculated, respectively. Then the external σT_{eff} for the appropriate samples were estimated from the variances through extracting the known $\sigma T_{\text{eff}}=49$ K for S.1, the latter value was taken from Malyuto & Shvelidze (2011). The results are presented in Table 1. There is a nice correspondence between the external σT_{eff} and the published qT_{eff} for S.2A, S.2B, S.2C, respectively. For S.3 and S.4, the obtained external σT_{eff} are very similar to the mean published σT_{eff} , respectively. Therefore, the published σT_{eff} should be reliable.

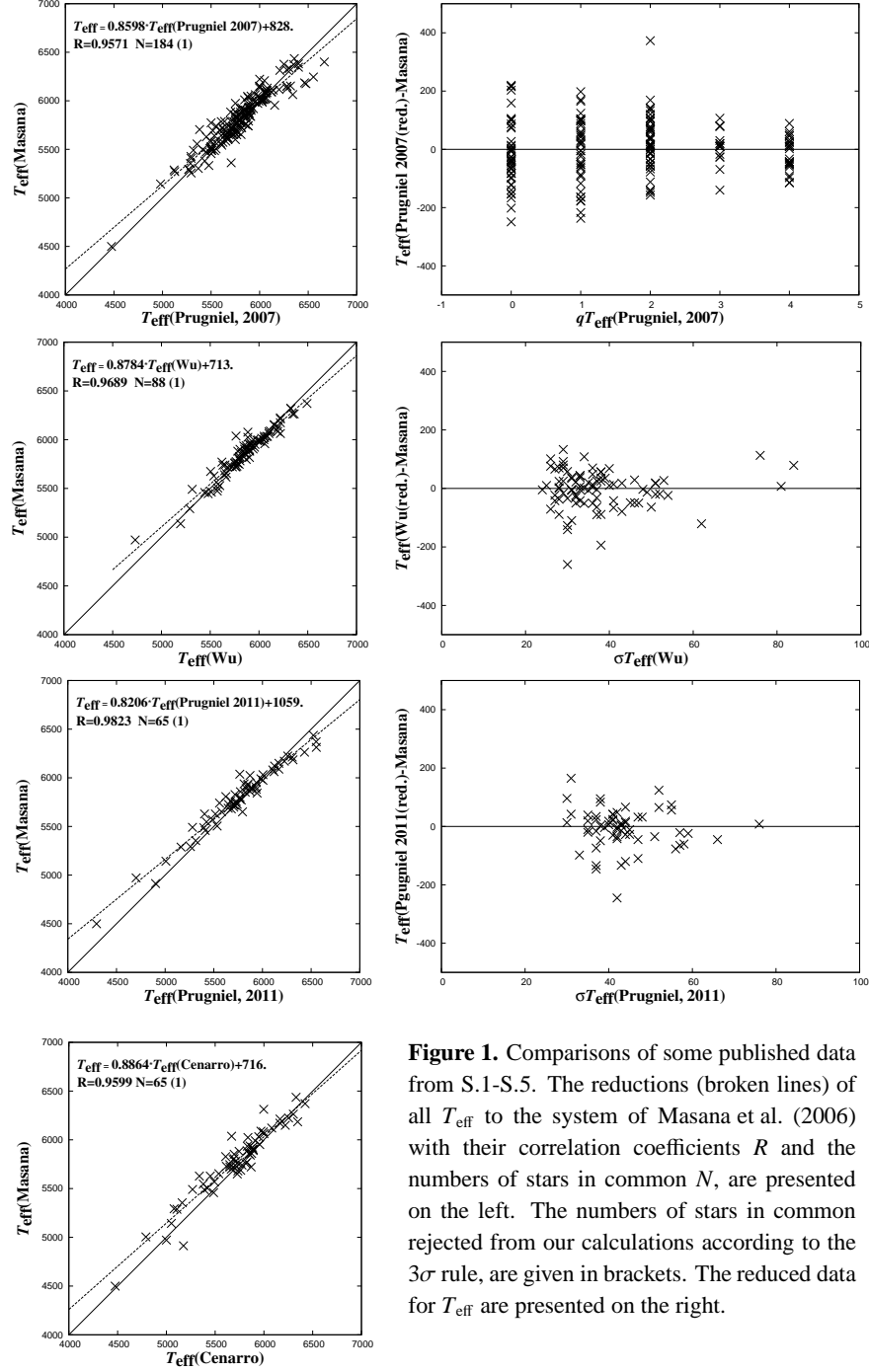


Figure 1. Comparisons of some published data from S.1-S.5. The reductions (broken lines) of all T_{eff} to the system of Masana et al. (2006) with their correlation coefficients R and the numbers of stars in common N , are presented on the left. The numbers of stars in common rejected from our calculations according to the 3σ rule, are given in brackets. The reduced data for T_{eff} are presented on the right.

Table 1. External σT_{eff} for S.2-S.5 obtained from the comparison with S.1. Some published data and the numbers of stars in common N are given at the end of this Table.

Pair	S.2A	S.2B	S.2C	S.3	S.4	S.5
S.1, S.2A	33	—	—	—	—	—
S.1, S.2B	—	64	—	—	—	—
S.1, S.2C	—	—	98	—	—	—
S.1, S.3	—	—	—	35	—	—
S.1, S.4	—	—	—	—	38	—
S.1, S.5	—	—	—	—	—	80
Published qT_{eff}	3-4	2	0-1	—	—	—
Mean published σT_{eff}	—	—	—	37 ± 11	44 ± 9	—
N	42	51	88	86	60	60

However, the external σT_{eff} for S.5 is significantly larger than for S.4 (80 K and 38 K, respectively). The difference may occur because in the compilation for MILES library Cenarro et al. (2007) used the procedure of data homogenization where heterogeneity of the published errors (or other quality data) of the parameters inside every used sample has not been taken into account. Our comparisons of T_{eff} for some catalogues (Malyuto & Shvelidze 2011) have shown that the use of samples where the published σT_{eff} are within some selected intervals really helps us deal with more homogeneous data of T_{eff} . Therefore, such errors should be involved in homogenization process.

3. Conclusions

The technique of estimating the errors of catalogues from data intercomparisons has been applied to some samples of the published T_{eff} for spectral libraries. The results will be used for producing an extended mean homogenized catalogue of T_{eff} . The same approach may be applied also for the treatment of other kinds of data. The stars with the most reliable parameters may then serve as templates in classification. Support from the Estonian Science Foundation (grant No. 7765) is acknowledged.

References

- Cenarro A. J., et al., 2007, MNRAS, 374, 664
Malyuto V., Shvelidze T., 2011, Baltic Astronomy, 20, 91
Masana, E., Jordi, C., Ribas, I., 2006, Astronomy and Astrophysics, 450, 735
Prugniel, Ph., et al., 2007, arXiv:astro-ph/0703658
Prugniel, Ph., Vauglin, I., Koleva, M., 2011, Astronomy and Astrophysics, 531, A165
Wu Y., et al., 2011, Astronomy and Astrophysics, 525, A71